

REMARKS

The Office Action dated November 3, 2003 has been received and carefully studied.

The Examiner objects to claims 5 and 6 because the wording is identical. By the accompanying amendment, claim 6 has been cancelled.

The Examiner continues to reject claims 1, 3, 7 and 11-15 under 35 U.S.C. §102(b) as being anticipated by Böhnstedt, U.S. Patent No. 5,776,630. The Examiner states that Böhnstedt teaches continuous longitudinal ribs and transverse ribs that can have an angular cross-section with equal-sided trapezoidal sections.

By the accompanying amendment, claim 1 has been amended to recite that the microporous sheet comprises ultra high molecular weight polyethylene, and claims 1, 13 and 15 have been amended to recite that there are two to four elongated vertical ribs in the center area of at least the first side of the sheet. Support for the amendment can be found at page 4, second paragraph of the specification, and in original claim 3. Claim 3, rendered redundant by the amendment, has been cancelled.

Böhnstedt discloses separators which are provided with longitudinal and transverse ribs. It is the Examiner's position that Böhnstedt anticipates the separators of the present invention since in his opinion, the transverse ribs of Böhnstedt represent the instantly claimed plurality of studs. The Examiner further notes that Böhnstedt does not state the transverse ribs intersect the longitudinal ribs and concludes that Böhnstedt teaches that the transverse ribs may have a length of at least 4 mm.

It was found by Böhnstedt that the height of the ribs of regular separators cause an unfavorable torque for forces acting on the ribs, which results in distortions of the separators (column 1, lines 24-28). It is the object of Böhnstedt to overcome this problem and to provide separators which have increased rigidity both in the longitudinal and transverse directions (column 1, lines 56-58).

According to Böhnstedt, this problem is solved by separators which, in addition to longitudinal ribs, have transverse ribs (column 1, line 65 to column 2, line 1).

A typical separator according to Böhnstedt is shown in Figures 1a and 1b. As can be seen from these figures, in particular from Figure 1b, the transverse ribs intersect the longitudinal ribs, thereby reducing the torque for forces acting on the ribs. Those skilled in the art immediately would understand that this object is only achieved if the transverse ribs intersect the longitudinal ribs, because otherwise no improvement of the torque forces would be possible. At the intersections, the lever for forces acting on the longitudinal ribs, and thus the torque, is reduced. Thus, the transverse ribs do not represent "studs" according to the present invention, which have the form of isolated elevations (see Figure 1 of the present application). In fact, from the foregoing it is clear that Böhnstedt teaches away from the use of such studs.

The present specification clearly distinguishes between studs and transverse ribs such as those disclosed by Böhnstedt. Indeed, the second paragraph on page 8 of the present specification specifically refers to the transverse ribs of Böhnstedt, stating that the separators of the invention may have, in addition to the longitudinal ribs and the studs, transverse ribs as disclosed by Böhnstedt to increase rigidity. Thus, the transverse ribs of Böhnstedt can be used in addition to the instant studs, but cannot replace the studs of the present invention and are different from the studs of the instant invention.

Moreover, according to Böhnstedt, the longitudinal ribs are spaced apart 8 to 15 mm (column 2, line 35), i.e., the transverse ribs must have a length of at least 8 mm. The Examiner notes that the longitudinal transverse ribs may form a herringbone pattern. In such a herringbone pattern, the transverse ribs intersect the longitudinal ribs at an angle other than 90°. As a result, the length of the transverse ribs is increased.

A transverse rib intersecting a plurality of longitudinal ribs being spaced apart 8 mm at an angle of 90° is divided by the longitudinal ribs into segments having a length of 8 mm. If, for instance, the angle is 45° or 135°, the transverse ribs are divided into segments having a length of 11.3 mm. Consequently, Böhnstedt does not disclose separators which are provided with a plurality of studs having the form of non-continuous ribs with a length of less than 0.5 cm (5 mm) as required by the instant claims.

In addition, in order to even further distinguish Böhnstedt, claim 1 has been amended to recite that the number of longitudinal ribs is between two and four. As is explained in the first paragraph on page 6 of the instant specification, separators for starter batteries typically have widths of about 160 mm. According to Böhnstedt, the longitudinal ribs are spaced apart 8 mm to 15 mm, and thus a typical separator includes about 10 to about 20 longitudinal ribs. Indeed, the separator shown in Figure 1 of Böhnstedt includes 12 ribs. This is many more than the upper limit of such ribs as now recited in claim 1.

The Examiner newly rejects claims 1, 5-8, 11, 12 and 14 under 35 U.S.C. §103(a) as being unpatentable over Wells, U.S. Patent No. 2,117,382 in view of Linden, Handbook of Batteries. The Examiner states that Wells teaches a storage battery having a microporous separator formed of material pervious to the electrolyte and inert to the battery, with one side provided with isolated lugs of square, round, diamond or other shape forming discontinuous ribs. The Examiner states that Wells discloses that it may be desirable to provide the separator with continuous vertical ribs in the center area of the sheet. Linden is cited for its disclosure of pocket separators.

The rejection is respectfully traversed.

Wells discloses storage battery separators. It is the object of Wells to provide separators which are more satisfactory than the commonly employed separators having vertical ribs (column 1,

lines 1 to 6). Wells does not disclose pocket separators.

The separators of Wells are made from microporous rubber (column 2, lines 34 to 35). As can be seen from Linden, separators made from microporous rubber are used for heavy-duty batteries (page 24.29, 3rd paragraph). Heavy-duty batteries usually do not contain pocket separators, and in addition, microporous rubber is completely unsuitable for the production of pocket separators because this material cannot be welded and because this material is too brittle (Linden, Table 24.10). Accordingly, Wells is concerned with a totally different type of battery than the present invention, and those skilled in the art would not have used separators disclosed by Wells for the production of pocket separators. In addition, those skilled in the art would not be motivated to modify the separator of Wells to form pocket separators because of the aforementioned unsuitability of pocket separators in heavy-duty batteries.

Moreover, while Wells mentions that the separators may have a central vertical rib (column 4, lines 35 to 37), Wells does not describe any advantages of such a central vertical rib. Wells therefore does not provide an incentive to use separators having a central vertical rib, let alone more than one central vertical rib. To the contrary, Wells describes in detail the disadvantages which are associated with vertical ribs (column 1, lines 7 to 29) and therefore teaches away from separators comprising vertical ribs.

A skilled artisan considering Wells as the closest prior art would have to perform several modifications to the separators of Wells in order to arrive at the present invention. First, one would have to select a separator design which is explicitly indicated by Wells to be disadvantageous, i.e., a separator provided with isolated lugs in combination with more than one central vertical rib. Second, one would have to replace the preferred separator material of Wells, microporous rubber, with a different material having different properties, namely, ultra high molecular weight

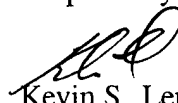
polyethylene. Third, one would have to convert the separator of Wells into pocket separators.

Applicants respectfully submit that the skilled artisan would have no motivation to make any of these modifications to Wells. Indeed, one of the main problems solved by the present invention is the avoidance of assembly problems during the pocketing of electrodes and battery production (page 3, 3rd paragraph of the specification). Wells does not mention pocket separators, and therefore does not and cannot suggest the use of a certain separator design to avoid problems associated with the pocketing of battery electrodes.

The separators of the present invention as now claimed include two to four vertical ribs. When pocketed, the electrode plate is supported by these ribs, i.e., the plate is supported at two to four positions which, for instance, reduce the risk of a direct contact of the bottom edge of the positive electrode plate with the separator sheet. Wells teaches away from the use of central vertical ribs. At best, Wells discloses a separator having one central vertical rib, and does not teach or suggest pocket separators having two to four central vertical ribs as now recited in the instant claims.

Reconsideration and allowance are respectfully requested in view of the foregoing amendment and remarks.

Respectfully submitted,



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Amendment to the Claims

This listing of claims replaces all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently amended) A pocket battery separator for a lead-acid storage battery having a useful life, said separator comprising a microporous sheet comprising ~~synthetic resin~~ ultra high molecular weight polyethylene having a center area and side areas and being provided with a plurality of studs in the center area of at least a first side of the sheet, characterized in that the separator additionally comprises ~~at least one~~ two to four elongated continuous vertical ~~rib~~ ribs in the center area of at least said first side of the sheet provided with a plurality of studs, said at least one elongated continuous vertical ~~rib~~ ribs and said plurality of studs remaining on said sheet during said useful life, said studs having a shape selected from the group consisting of spherical caps, semi-spheres, truncated pyramids, truncated cones and non-continuous ribs having a length of ~~not~~ not more than 0.5 cm.

2. (Cancelled)

3. (Cancelled)

4. (Cancelled)

5. (Previously presented) The separator as defined in claim 1 wherein said at least one elongated vertical rib has the same or a lower height than the studs.

6. (Cancelled)

7. (Original) The separator as defined in claim 1 wherein the studs and the ribs are solid bodies integrally formed of the same material as the separator sheet.

8. (Previously presented) The separator as defined in claim 1 wherein the ribs are formed of a different material than the separator sheet.

9. (Cancelled)

10. (Cancelled)

11. (Previously presented) The separator of claim 1 in which the studs and vertical ribs are provided on the inner surface of the pocket.

12. (Previously presented) The separator of claim 1 wherein the at least one elongated rib is arranged in the bottom edge area of the separator pocket.

13. (Currently amended) A rolled-up battery separator for a storage battery having a useful life, said separator comprising a porous sheet having a center area and side areas and being provided with a plurality of studs on at least a first side of the sheet, characterized in that the separator additionally comprises ~~at least one~~ two to four elongated continuous vertical ~~rib~~ ribs in the center area of at least said first side of the sheet provided with a plurality of studs, said plurality of studs and said at least one elongated vertical ~~rib~~ ribs remaining on said sheet during said useful life, said studs having a shape selected from the group consisting of spherical caps, semi-spheres, truncated pyramids, truncated cones and non-continuous ribs having a length of ~~not~~ not more than 0.5 cm, said separator being adapted to be cut into pieces for insertion in said storage battery.

14. (Original) A lead acid storage battery comprising at least one separator according to claim 1.

15. (Currently amended) A pocket battery separator for a lead-acid storage battery, said separator being a microporous sheet consisting essentially of a homogeneous mixture of 8 to 100 vol.% polyolefin, 0 to 40 vol% plasticizer and 0 to 92 vol.% inert filler, said sheet having a center area and side areas and being provided with a plurality of studs in the center area of at least a first side of the sheet, characterized in that the separator additionally comprises ~~at least one~~ two to four elongated continuous vertical ~~rib~~ ribs in the center area of at least said first side of the sheet provided with a plurality of studs, said studs having a shape selected from the group consisting of spherical

caps, semi-spheres, truncated pyramids, truncated cones and non-continuous ribs having a length of not more than 0.5 cm.